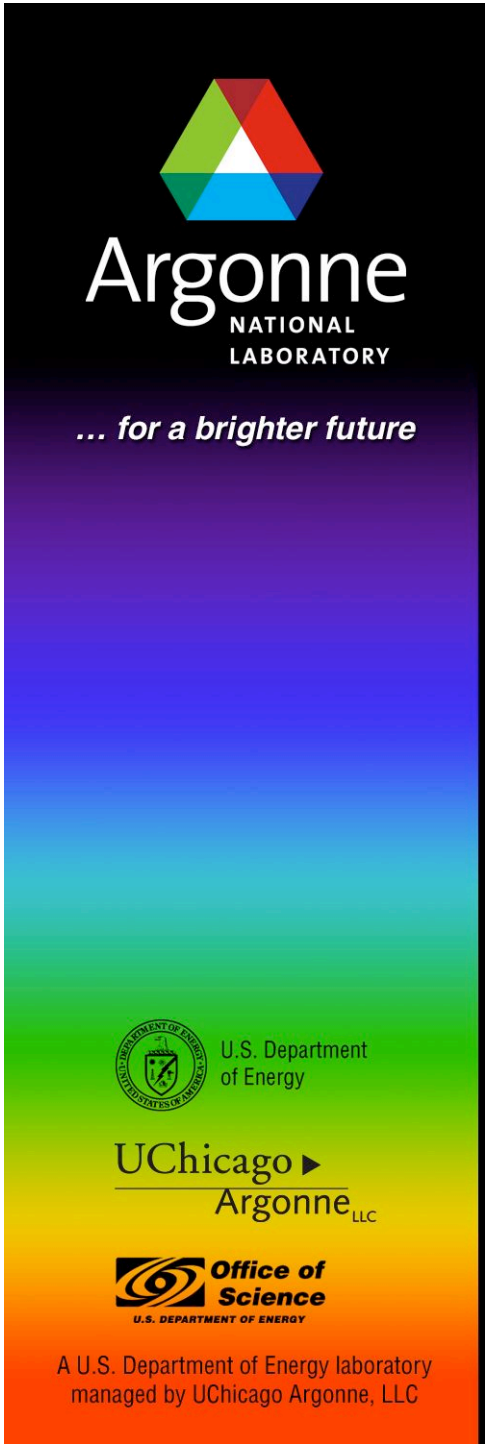
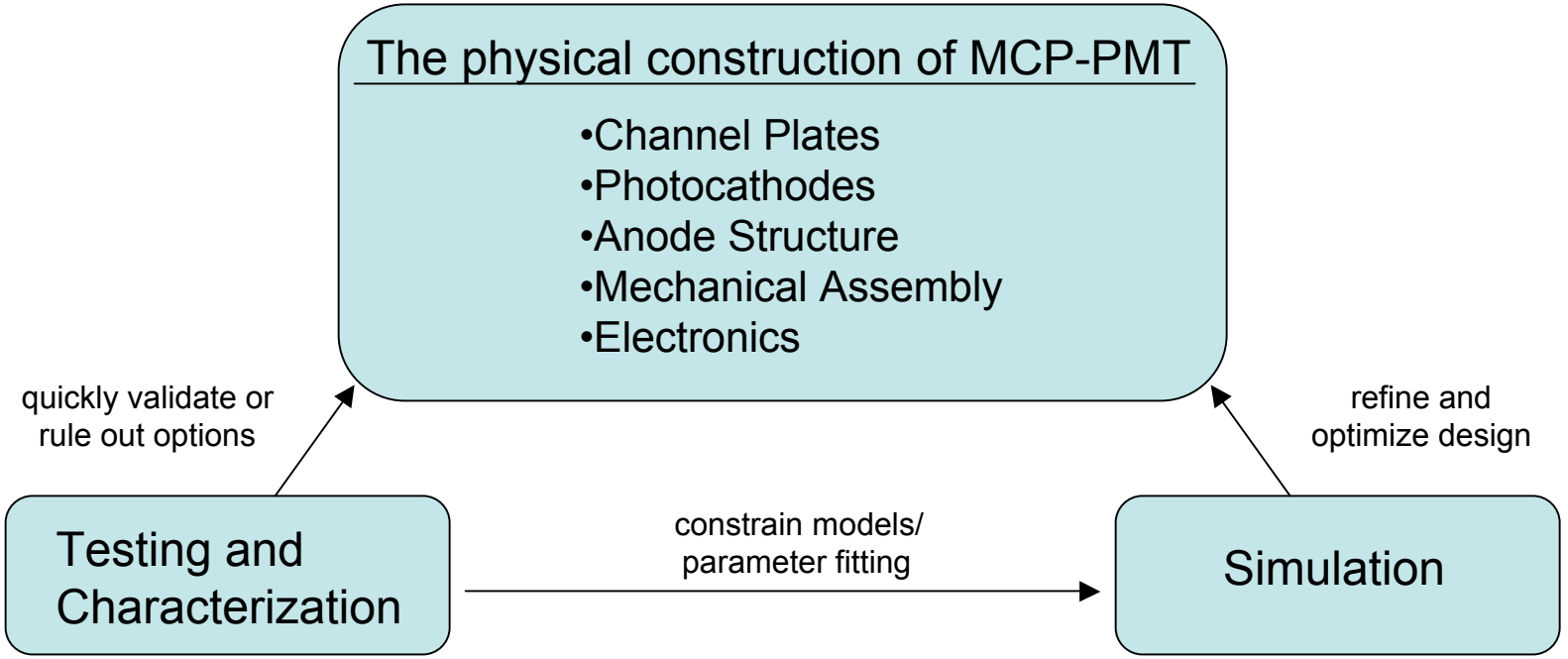


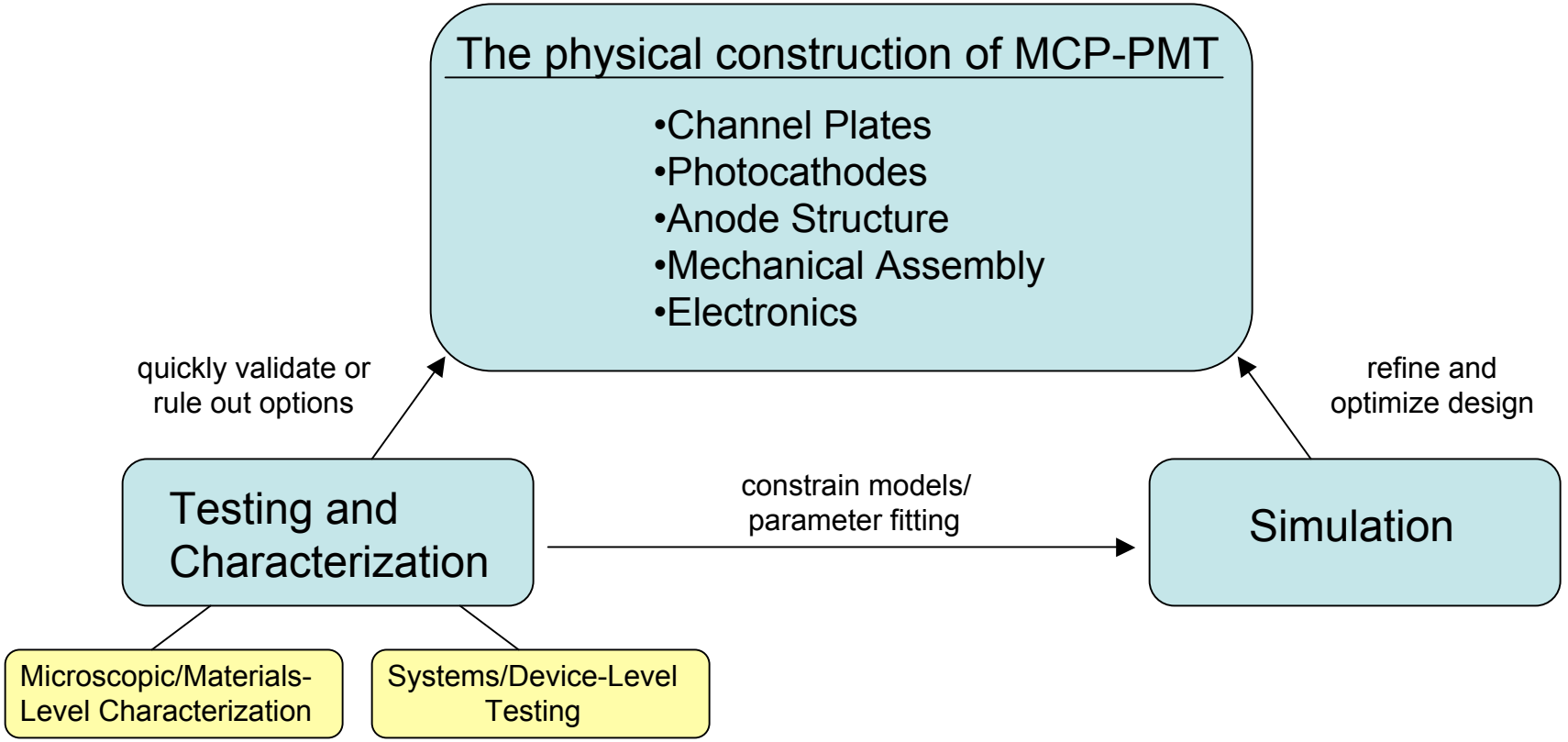
MCP and Photocathode Testing and Systems Integration At the Advanced Photon Source

B. Adams, K. Attenkofer, M. Chollet, Z. Insepov, J. McPhate, O. Siegmund, D. Walters, M. Wetstein, Z. Yusof
for the LAPPD Collaboration

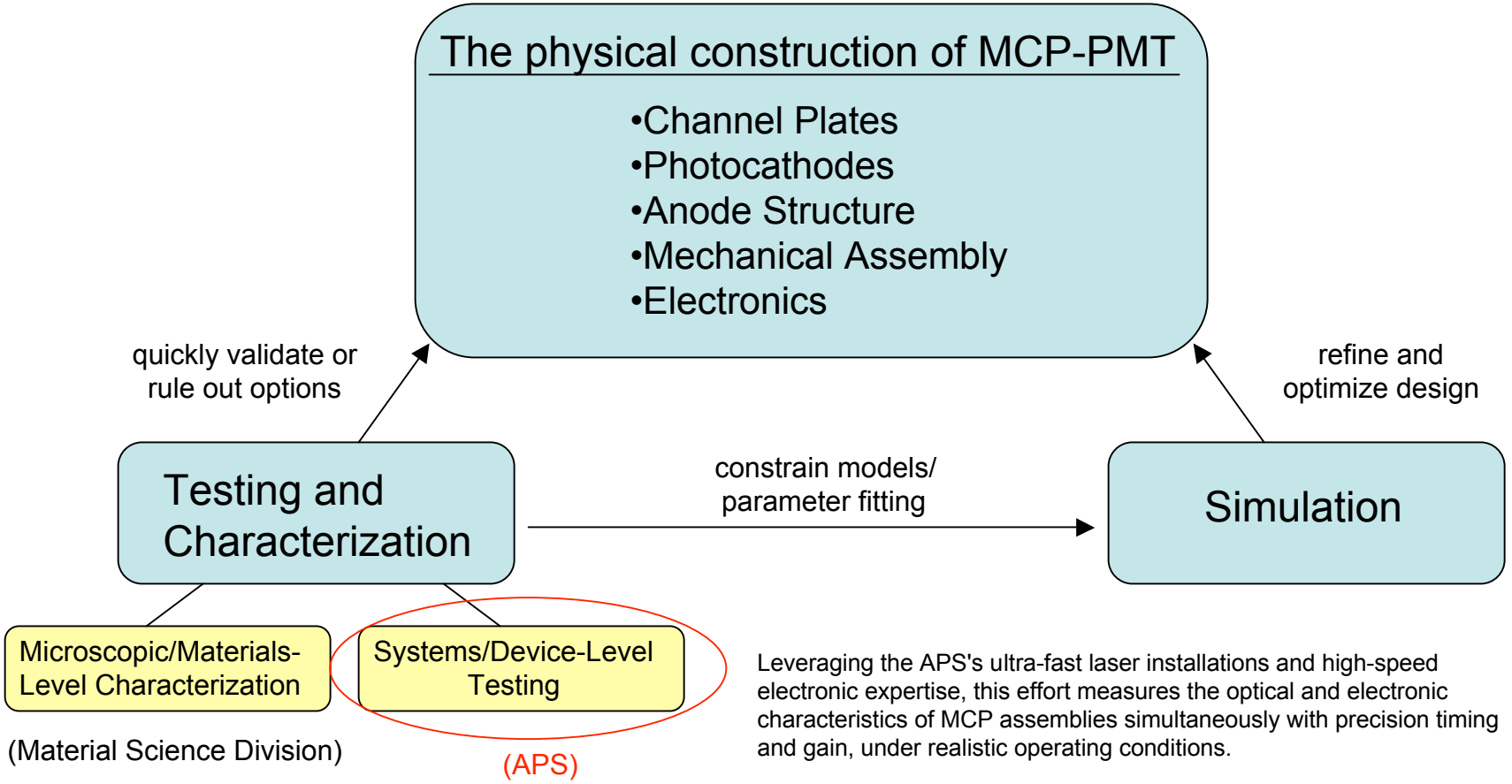
Goals of the APS Test Stand



Goals of the APS Test Stand



Goals of the APS Test Stand

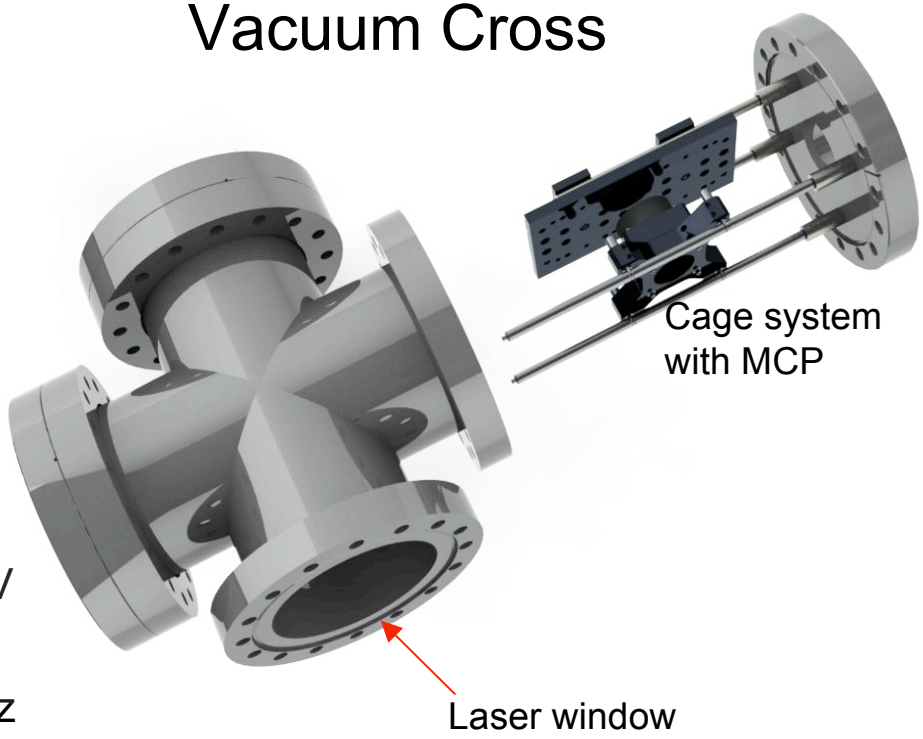


Leveraging the APS's ultra-fast laser installations and high-speed electronic expertise, this effort measures the optical and electronic characteristics of MCP assemblies simultaneously with precision timing and gain, under realistic operating conditions.

The Current Setup

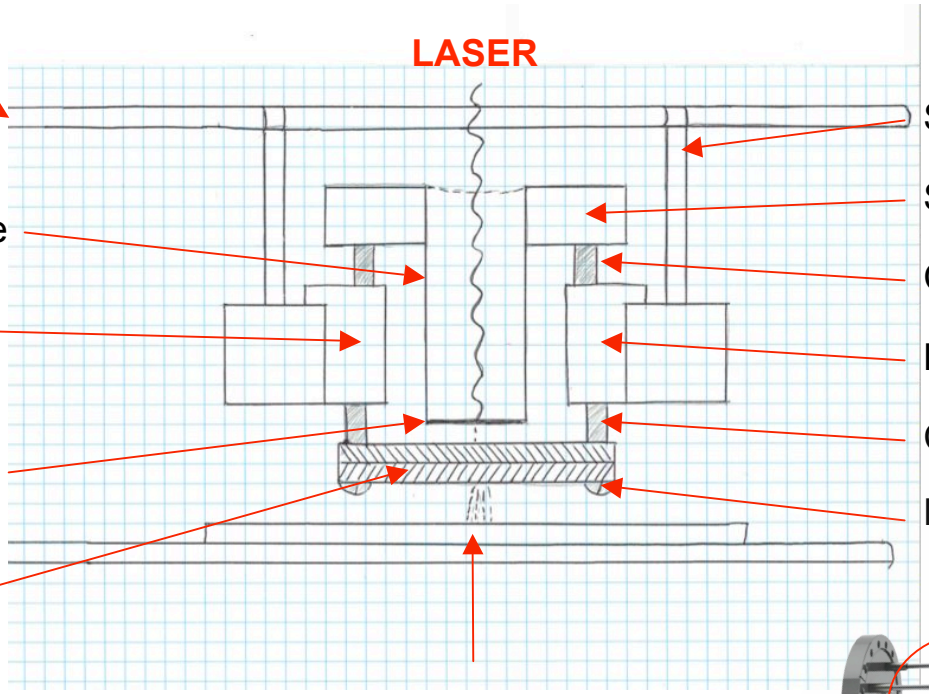
- Vacuum chamber operating at 10^{-7} torr level
- MCP/photocathode assembly mounted on optical cage system.
- Cage system attached to side-mounted flange with SMA and HV feedthroughs.
- Operation with or without photocathode (CsI on diamond)
- Ti:Sapphire laser (50 fs, 800 nm), frequency-tripled to 266 nm
- Voltage on photocathode: 0 - 4.0kV
- Voltage on MCP from 1.5-2.0kV
- Timing measurements using 8-GHz and 16 GHz scopes

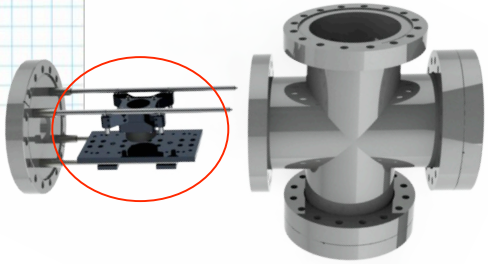
Vacuum Cross



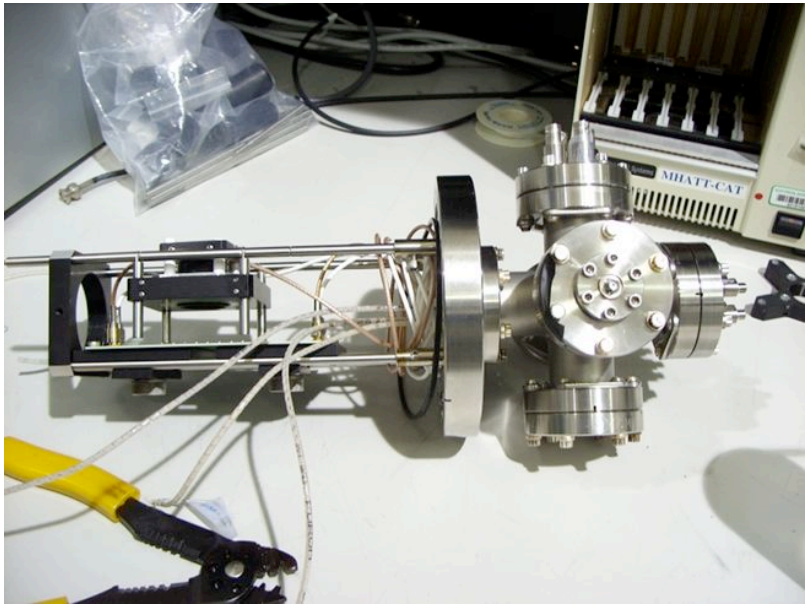
The Current Setup

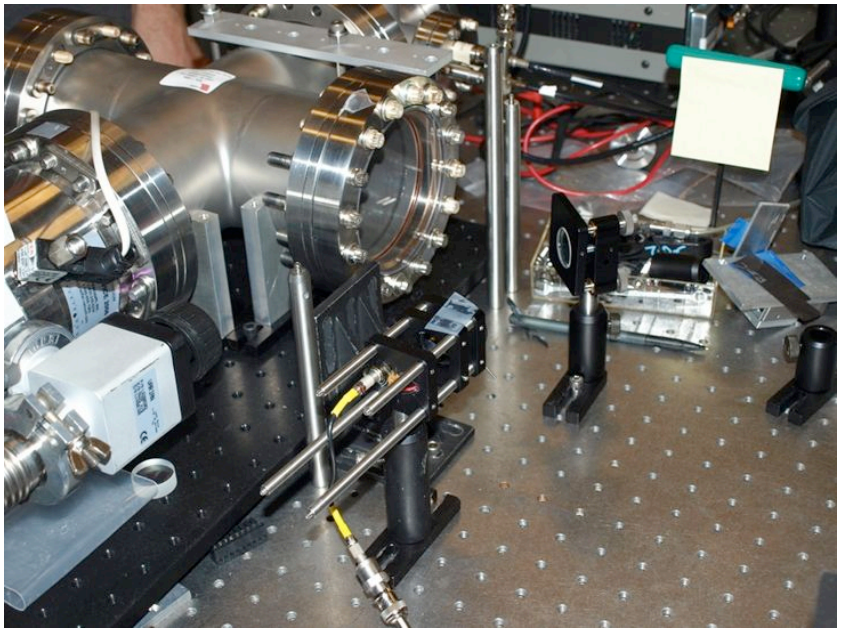
Cage system with MCP



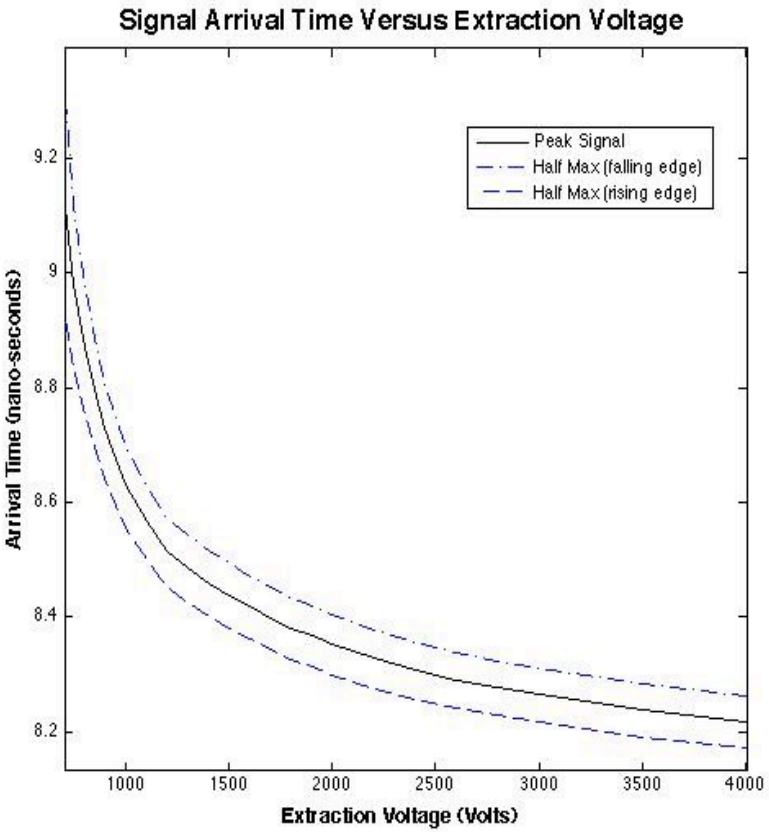


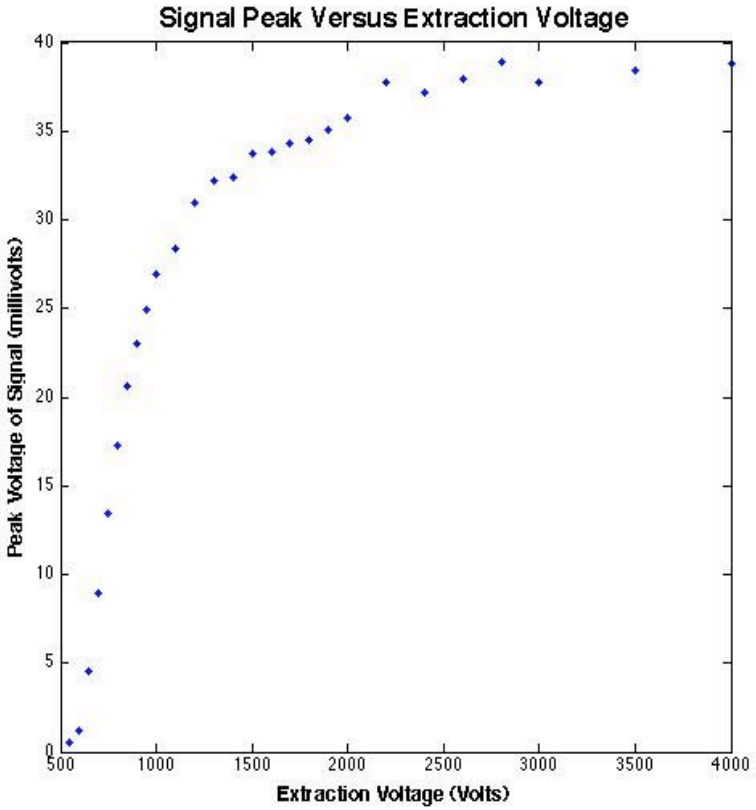
The Current Setup



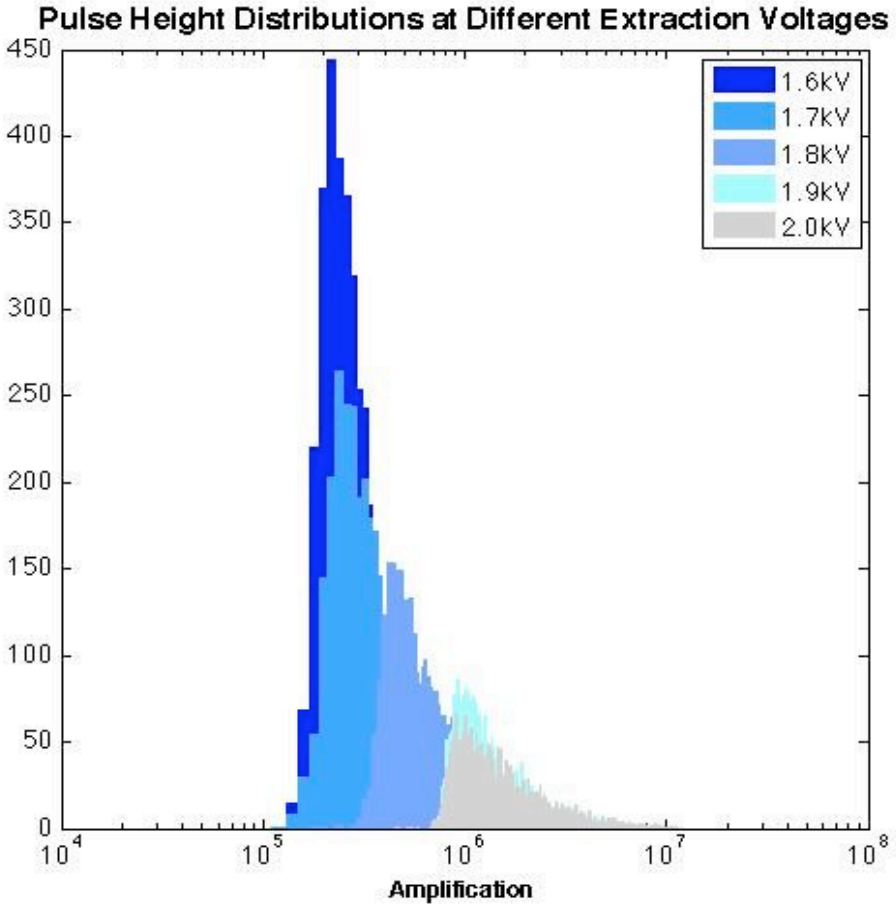


Results: Photocathode Measurement

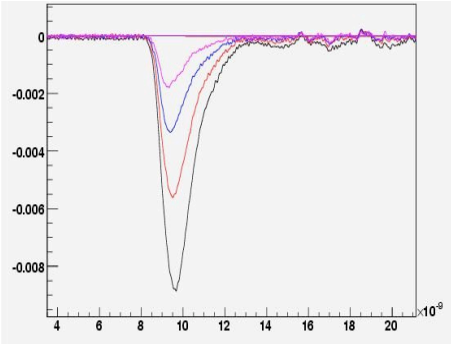




Results: MCP Measurement

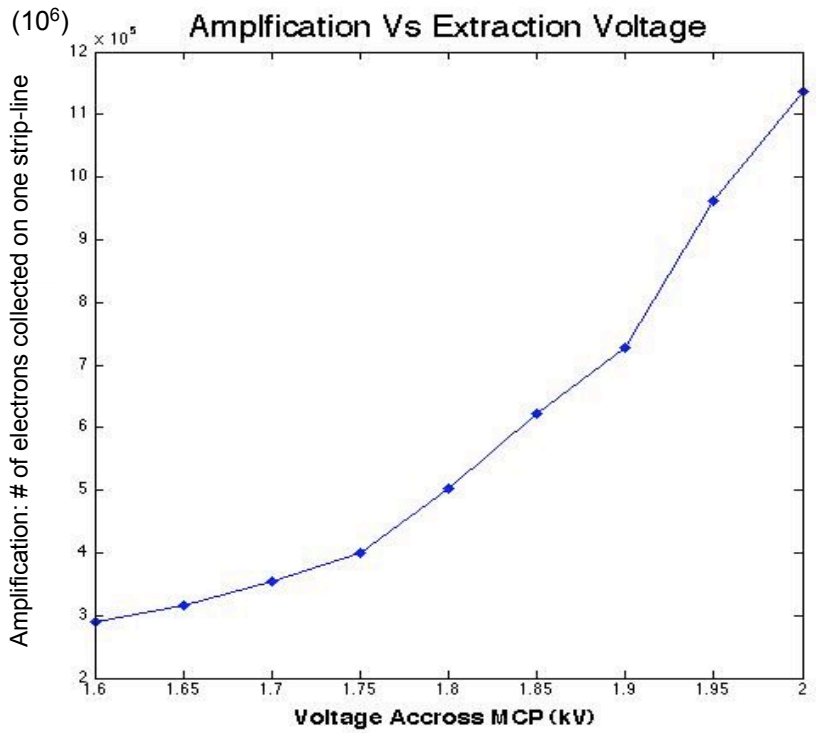


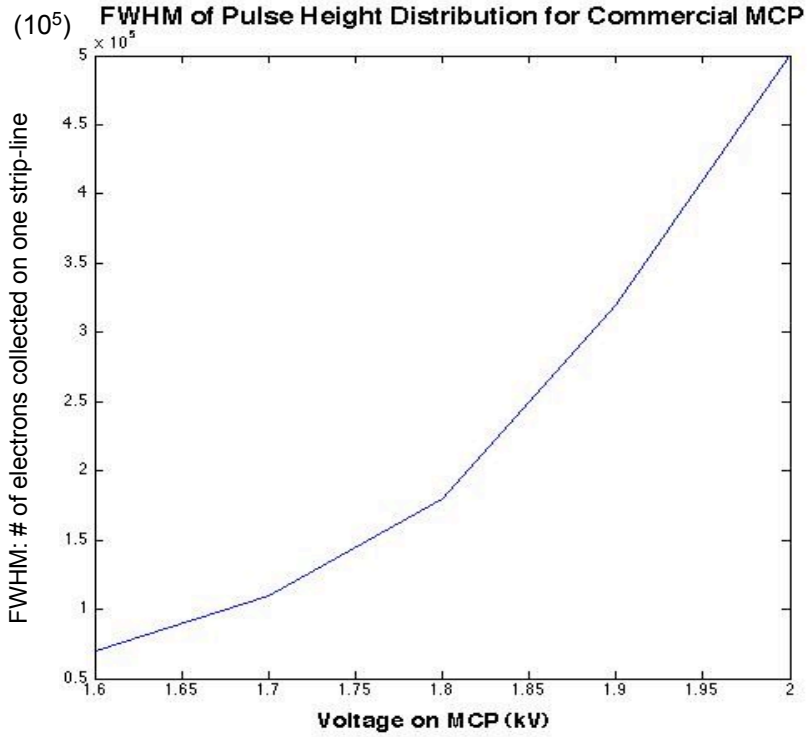
- Characterization of commercial Photonis MCP (The Chevron Model 3025).
- Amplification measured as integrated charge (# electrons) collected on a single stripline.
- Expected (total) amplification at 2kV: **~1x10^7**



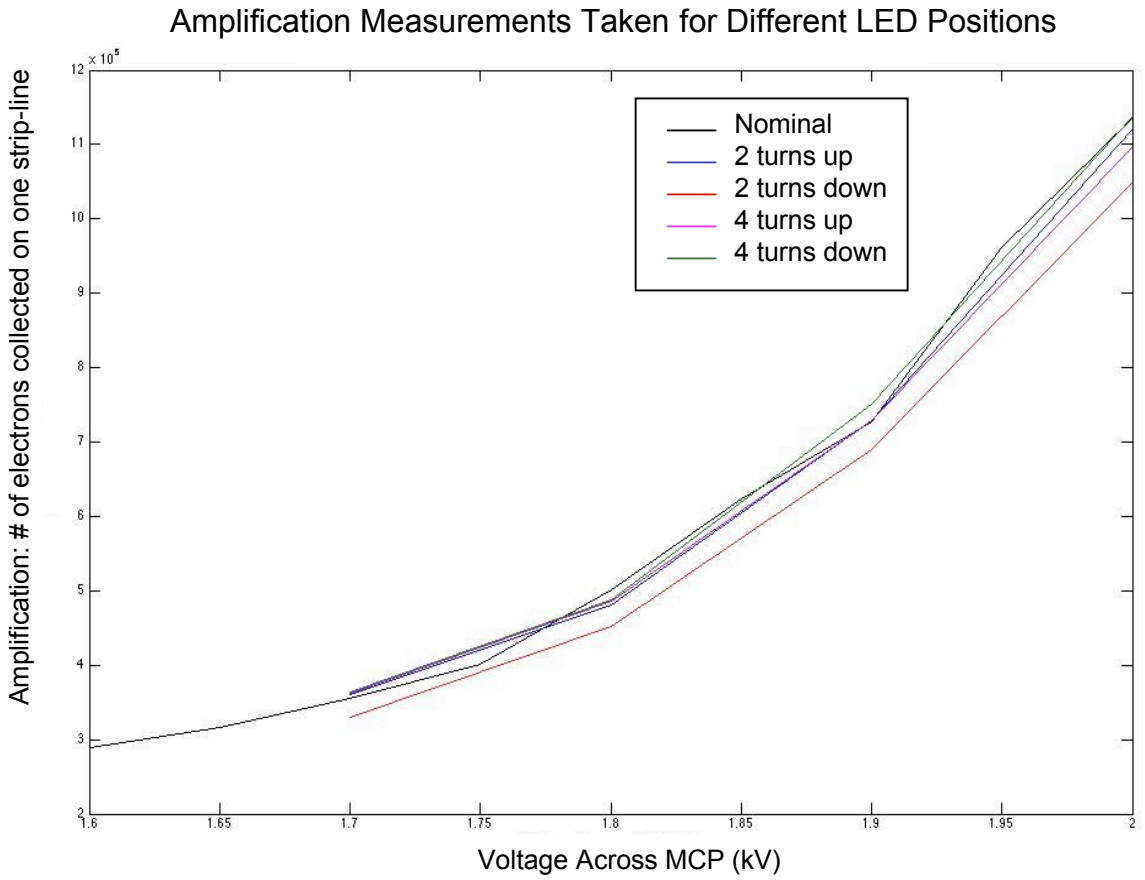
Example avg. scope signals at different MCP voltages.

Results: MCP Measurement

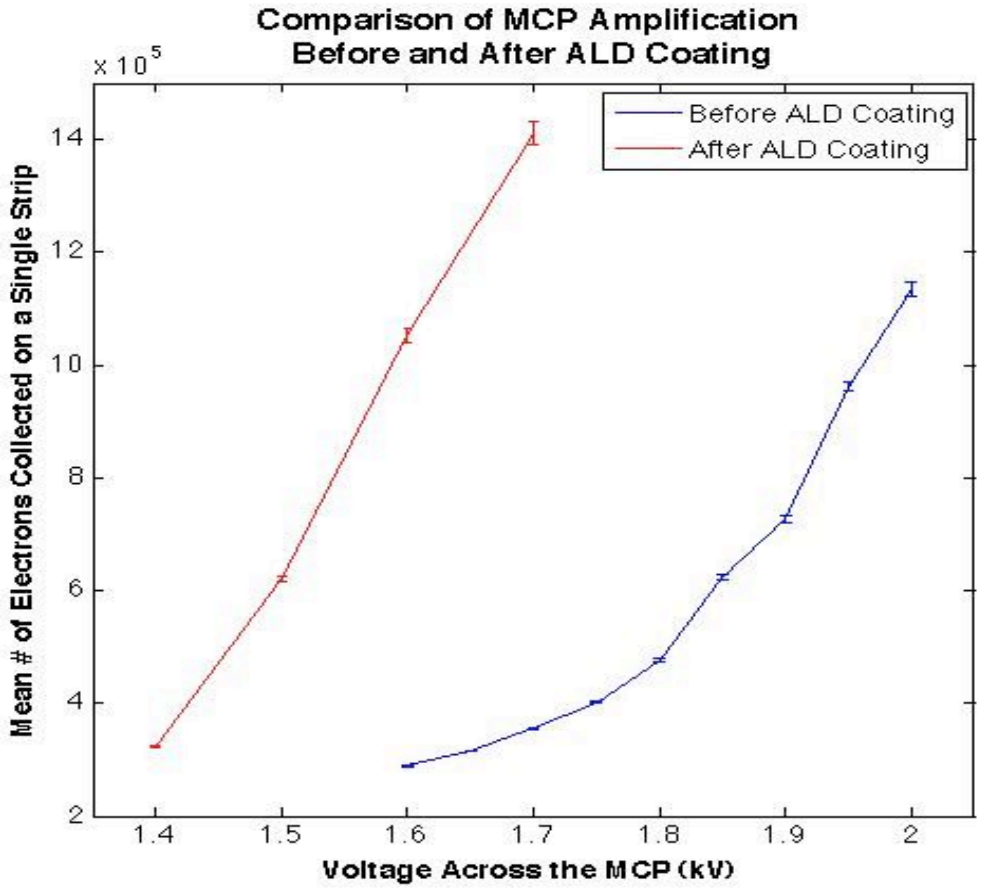




Results: MCP Measurement

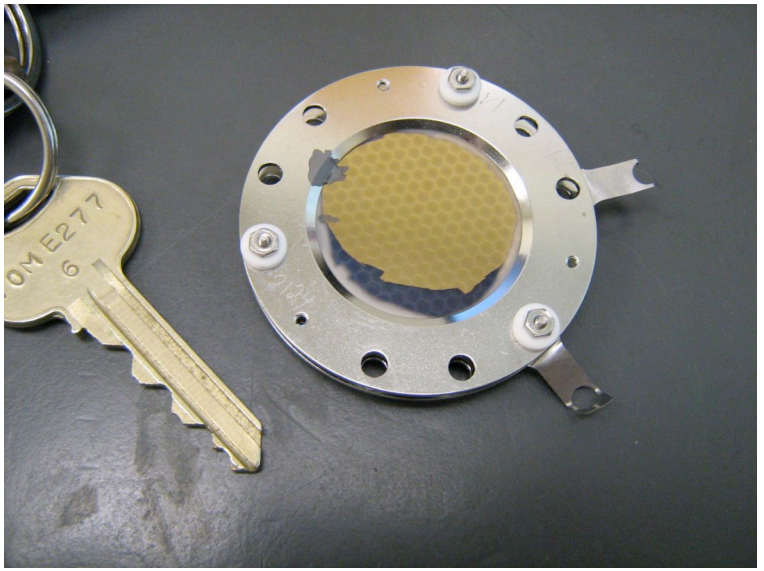


Results: MCP Measurement



- After characterizing the Photonis MCP, we coat the plates with 10 nm Al_2O_3.
- The “after-ALD” measurements have been taken without scrubbing.
- These measurements are ongoing.

Coming Soon: Tests of Functionalized Borosilicate Samples



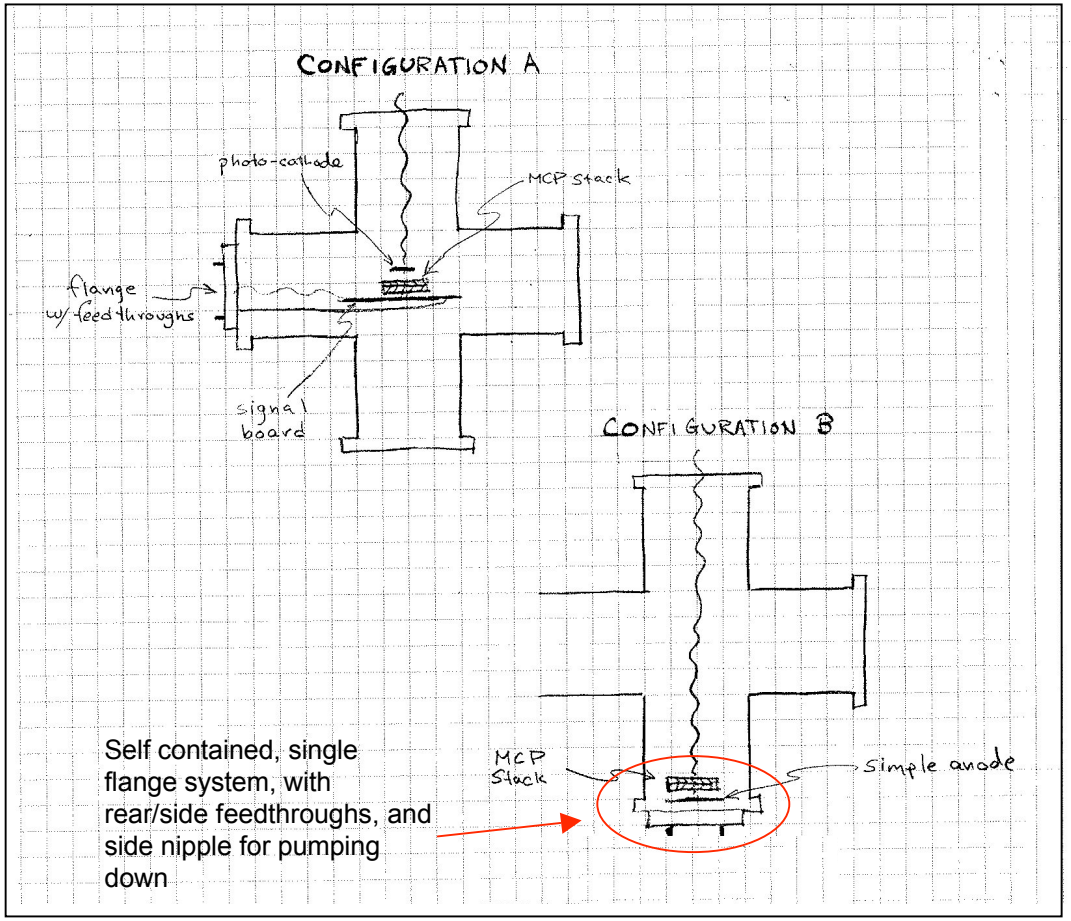
Near Future Plans:

The 'B' Configuration

- More compact arrangement of MCP's directly against a single flange. Minimal or no cabling. Simple or no photocathode. Simple stripline structure.
- Used for a precise and direct comparison of single or double channel plates, with all other variables held as constant as possible.
- Designed for simplicity, vacuum compatibility, interchangeability.
- Can be built while measurements are still taken on the current setup.
- Optical setup built onto modular, portable breadboards, and designed to handle a wide range of light sources.
- Can also be used with a well defined commercial MCP for photocathode characterization.
- Can be docked with a larger vacuum transfer system.

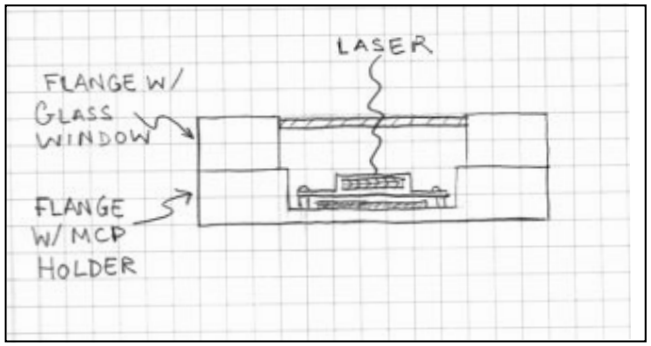
Near Future Plans:

The 'B' Configuration

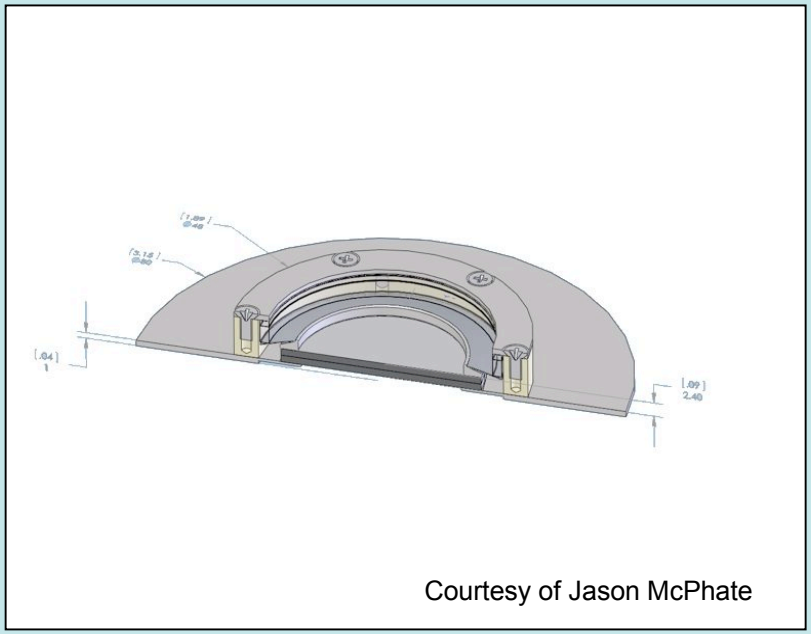


Self contained, single flange system, with rear/side feedthroughs, and side nipple for pumping down

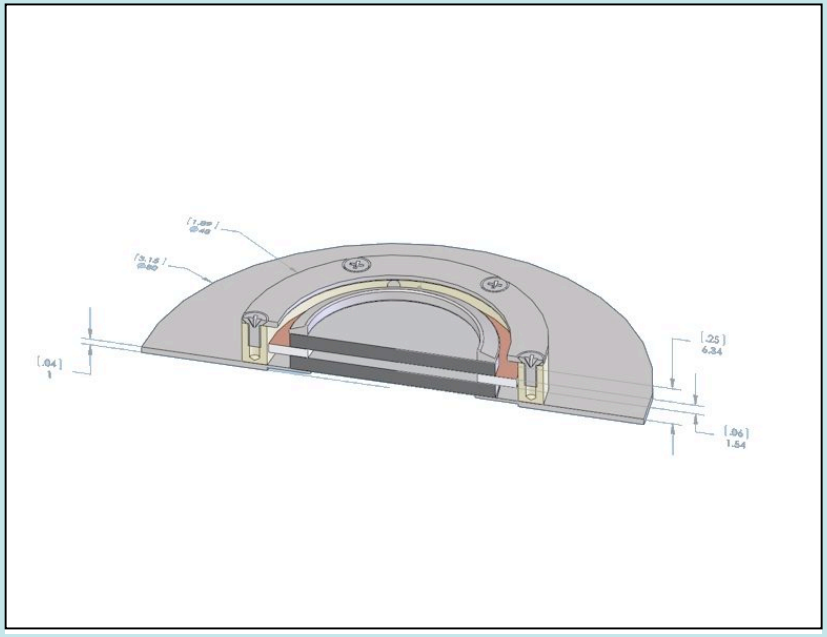
(Can also be attached to a single flange with glass window to form a compact, two-flange "MCP")



MCP Holder



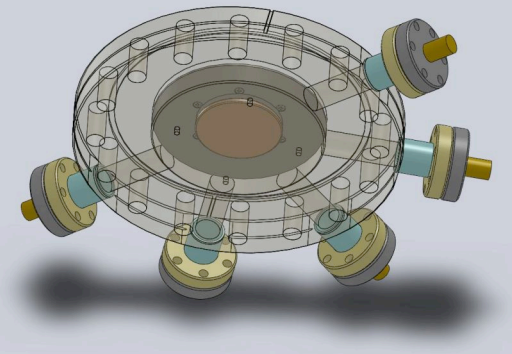
Courtesy of Jason McPhate



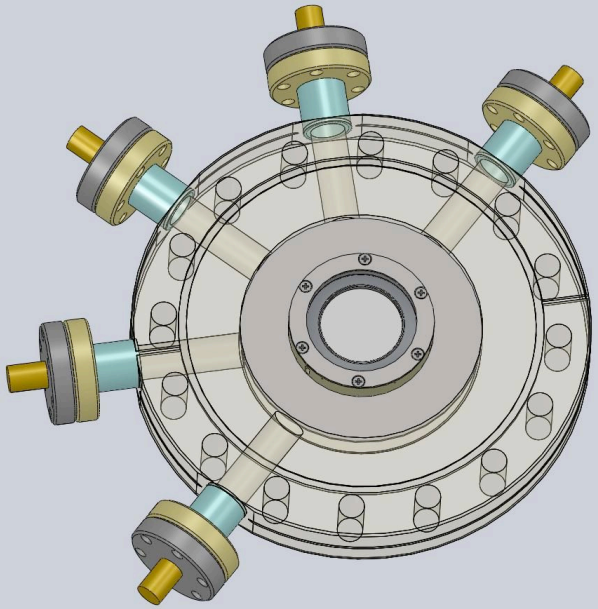
6” Con-flat flange:

(Side Feedthroughs)

Bottom



Top



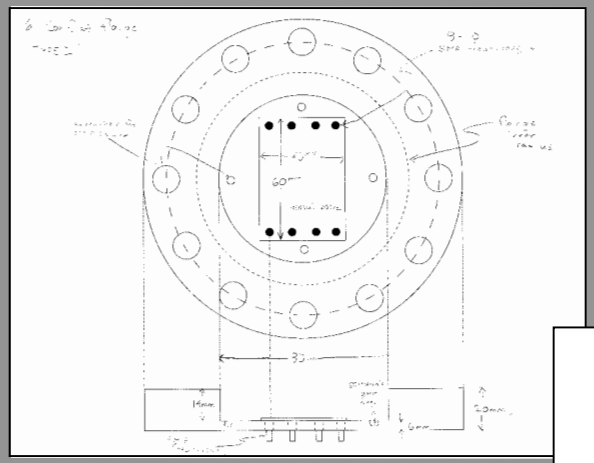
Courtesy of Dean Walters

- 4 High Voltage Feedthoughs
- 1 Feedthrough for pumping down

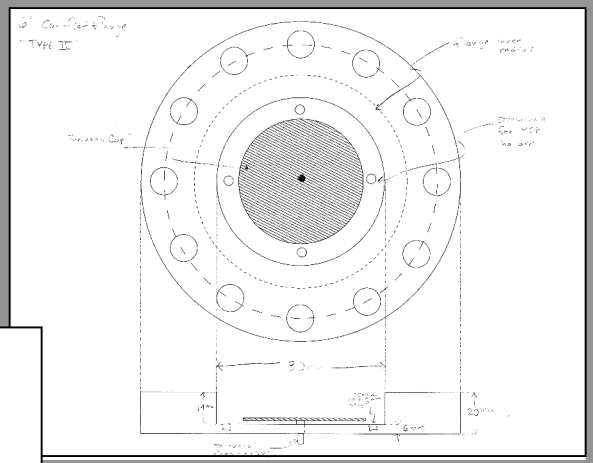
6” Con-flat flange:

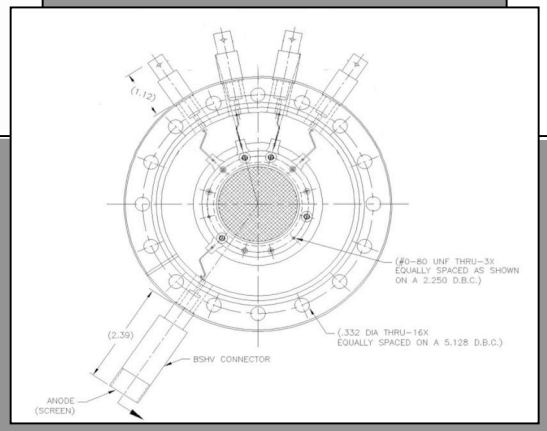
3 Basic Types

Flange with striplines for precision timing measurements



Flange with a single plate for amplification measurements





Flange with phosphor screen for testing image uniformity of single plates

Summary

- We have successfully assembled the right resources, man-power, expertise, and experience necessary to meet our testing goals.
- We are presently following 2 parallel tracks:

Current Setup

- Finishing up characterization of commercial MCP, before and after ALD.
- Long term gain study of MCP after ALD coating.
- Proof-of-principles test of MCP made using borosilicate glass with ALD coating.

Future Setup

- Finishing up design phase.
- Plan to be ready for comprehensive testing of ALD-based channel plates within the next two months.
- Working on developing vacuum transfer capabilities for tests of photo-cathode samples.